June 2005

RESIDENTIAL BUILDINGS
ENERGY CODE SUMMARY 2005

Overview

Montana homebuyers appreciate the comfort and warmth of well-designed, energy-efficient houses. With the recent upgrade of Montana's statewide energy code, home buyers now have peace of mind knowing that Montana houses meet the latest standards for energy efficiency. All new houses in Montana must meet the requirements of the 2003 International Energy Conservation Code (2003 IECC) with Montana amendments.

The statewide energy code also gives house buyers an additional tool to use in making their purchase decision–the "Energy Efficiency Components Label." This label is required in all new houses and is a way for the builder to inform the house buyer of the insulation levels, heating system efficiencies and other energy features of a new house. A sample is shown in Figure 6. The label also ensures that the information about these features is not lost over time. The label should be permanently attached to the house's electrical breaker box, so subsequent owners will have the same information available to them.

Cities, towns and counties with building code jurisdictions are required to enforce the state energy code in their jurisdictions. A listing of certified jurisdictions that have adopted building codes is available at **www.buildingcodes.mt.gov.** Outside of these building code jurisdictions, builders are required to meet the requirements of the energy code and show energy code compliance through a self-certification process. This means that the builder is required to provide a written statement to the homeowner that the house meets the state energy code requirements. The homebuilder or their agent provides this certification by signing and dating the energy-efficient components label.

Not only do home builders and home buyers benefit from this code, but Montana wins too. Energy-efficient homes consume less energy than homes not built to these standards. This means less energy has to be produced to heat and cool these homes which helps conserve our fossil fuel resources and protect Montana's environment.

What Buildings Are Covered Under The Statewide Energy Code?

The energy code applies to any residential building in Montana (with exceptions noted below) regardless of fuel type (gas, electricity or other). One and two family dwelling efficiency levels may vary slightly from multi- family dwellings. Residential buildings with more than 3 floors above ground must comply with the commercial energy code portions of the 2003 IECC code, excluding lighting provisions.

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Montana Department of Environmental Quality

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http://www.deq.mt.gov/Energy/index.asp

Buildings That Are Not Covered Under The Code

The following buildings are exempt from this code:

- Manufactured homes (*these are covered by HUD codes*)
- Buildings that are neither heated nor cooled or that have a peak design rate of energy use less than 3.4 Btu/h per square foot for space conditioning.
- Buildings that are classified or determined to be eligible for listing in the National Register of Historic Places.

Ways to Show Energy Code Compliance

There are three primary ways to demonstrate that one and two family dwellings meet the requirements of the Montana Energy Code - 2003 International Energy Conservation Code (IECC).

The component insulation levels required are dependent upon the efficiency level (U- value) and number and size of windows installed in the house. Almost all new windows are rated by the National Fenestration Rating Council (NFRC) by U-value. Because the U-value is the inverse of the R-value, a lower U-value indicates a window that has better insulating capabilities than a window with a higher U-value. Example: a U-.32 rated window is more efficient than a U-.35 rated window.

1. Follow the **simplified prescriptive path** - if applicable. The prescriptive path can be followed if the house has a 15% or less **window-to-exterior-wall ratio**. The majority of new Montana houses should be able to use this path.

TABLE 1. Simplified Prescriptive Path Requirements

Component	Insulation or Efficiency Level	
Ceiling	R-49	(R-38 is allowed if it can be achieved in the entire ceiling.)
Exterior wall	R-21	
Window	U - .35	
Floor	R-21	Over non-conditioned space
Crawlspace wall	R-20	For conditioned crawlspace
Basement wall	R-11	When finished
Slab on grade	R-13	From top edge for 4 feet, R-15 for in-floor heated slab.

2. Follow additional prescriptive paths, based on a window-to-wall ratio area – listed in Table 2.

3. Use a less restrictive REScheck™ computer analysis, a free download at **www.energycodes.gov** to show compliance, or other approved method.

How to determine **window-to-wall ratio**:

Example: 30 X 40 sq. ft. house with 8-foot high walls.
30 + 30 + 40 + 40 = 140 feet of wall
times 8 feet = 1120 sq. ft. of wall

Number of windows and rough opening sizes:

- 15 windows, all with a 3 ft. x 3 ft. rough opening
- 3 X 3 = 9 sq. ft. X 15 windows = 135 sq. ft. of window
- 135 / 1120 = 12% window-to-wall ratio.

TABLE 2 – Montana Energy Code
2003 International Energy Conservation Code
Prescriptive Packages for One and Two Family Dwellings
with U-Factors and R-Value Listings

Window/Wall Area	Window U-factor	Ceiling[A]	Exterior Wall[B]	Floor[C]	Basement Wall[D]	Slab[E]	Crawlspace Wall
8%	.42	38	16	19	11	8	16
12%	.40	49	21	19	10	9	17
15%	.35	49	21	21	11	13	20
18%	.33	49	25	30	15	–	25
20%	.30	49	26	21	11	12	19

The R-value requirement listings are for insulation material only, not for structural components such as drywall or siding.

A) Where R-49 is required, R-38 is acceptable if R-38 is placed in the entire ceiling. See Figure 4.

B) Steel framed wall requirements, where code requires wood framed walls to be insulated to R-21:
16-inch on center framing; R-13 cavity with R-10 foam sheathing or R-19 with R-9 foam sheathing.
24-inch on center framing; R-11 cavity with R-9 foam sheathing or R-21 with R-7 foam sheathing.

Structural Insulated Panels (SIP) with at least 5.5 inches of foam, and insulated concrete foam systems (ICF) with at least 2 inches of foam on each side, surpass the R-21 wall requirements because of their lack of thermal bridging.

A Montana amendment to the 2003 IECC states that “Lesser R-value may be allowed for log building walls.” REScheck can be used to show compliance.

C) The insulation levels listed in Table 2 are for floors over unconditioned areas, such as over crawlspaces and tuck-under garages. A floor over an exterior or outside area must meet the ceiling R-value requirement or R-38. If less than an 8% window-to-wall ratio, R-30. These areas include cantilevered floors and under bay window areas.

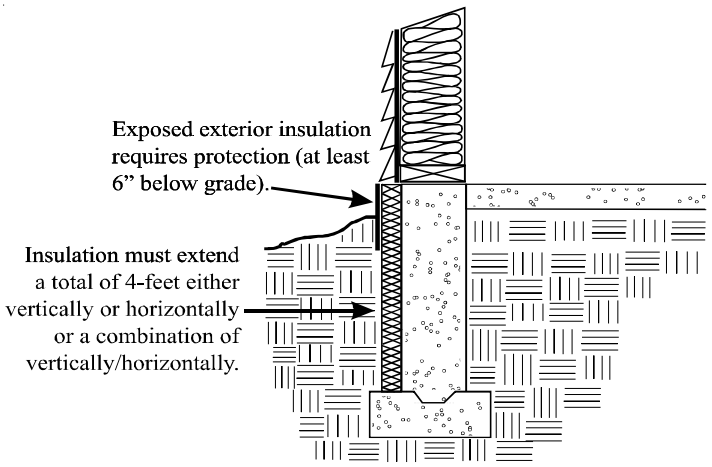
D) A Montana amendment to the 2003 IECC states that basement wall insulation may be delayed until the basement is finished for occupancy.

E) Slab-on-grade floors must be insulated to Table 2 levels. R-2 should be added to Table 2 levels for heated slabs such as radiant floor heat. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. The insulation should extend 4 feet by any combination of vertical and horizontal placement, that is extending out from the slab or under the slab (*see the Insulated Slab Options, Figure 1*). Insulation extending away from the building should be protected by pavement or at least 10 inches of soil. The top edge of the insulation installed between the exterior wall and the edge of the interior slab may be cut at a 45 degree angle. Exposed insulation shall have a weather-resistant protective covering extending at least 6 inches below grade level. Slab insulation is required on walk-out basement floors within 12 inches of grade.

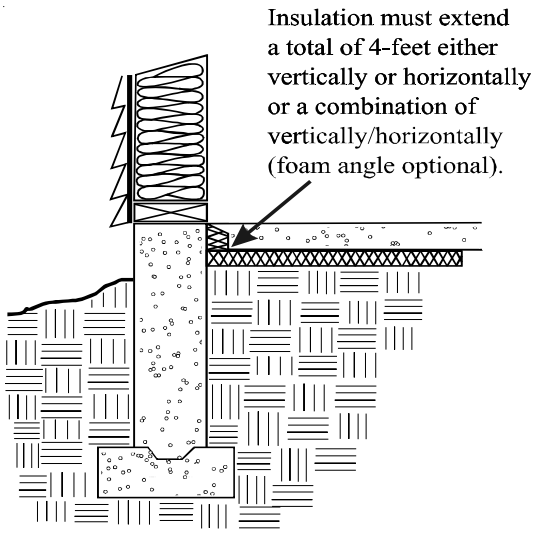
Insulated Slab Options

FIGURE 1

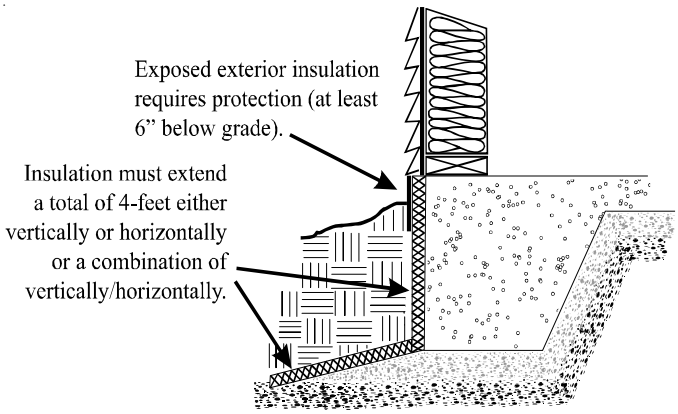
Option 1



Option 2



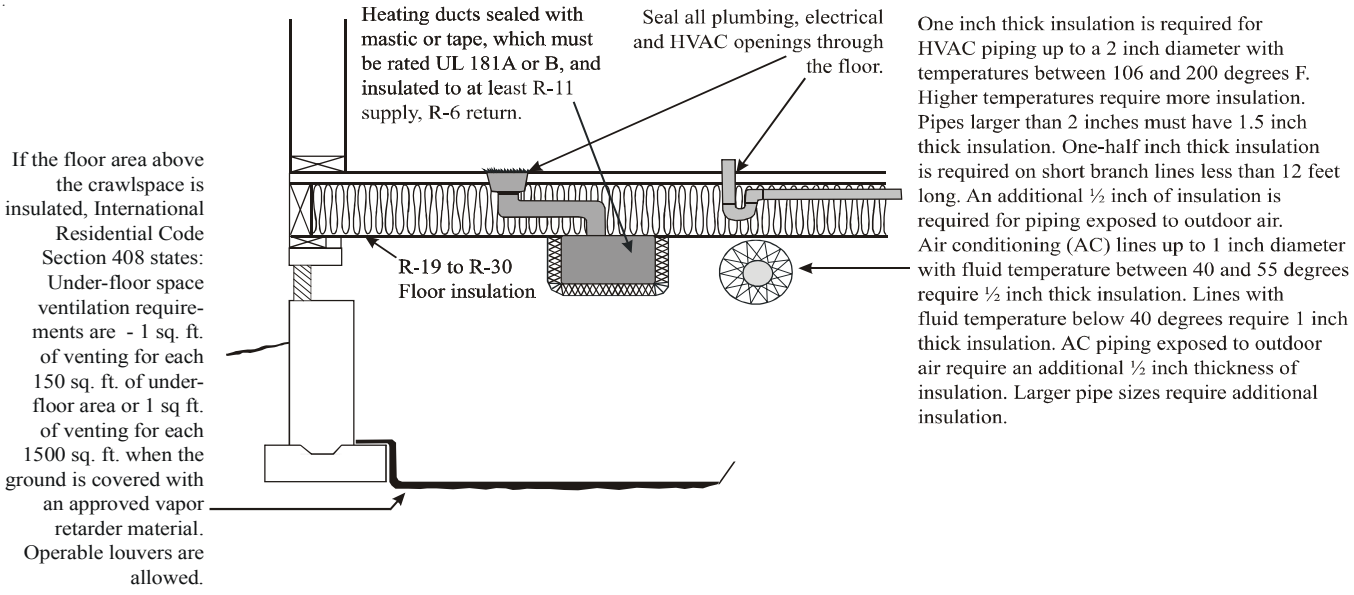
Option 3



Unconditioned Crawlspace with Floor Insulation and Foundation Vents

FIGURE 2

An option for insulating a crawlspace is to insulate the floor and install code required venting. This option treats the crawlspace as an unconditioned space. Insulation levels are listed in Table 2 under the floor requirements or follow REScheck requirements. Venting, air sealing, heating system sealing, duct and pipe insulation requirements are listed on Figure 2.



Nonvented Crawlspace with Foundation Wall Insulation

If the floor above a crawlspace is not insulated to at least Table 2 or REScheck™ floor insulation requirements, then a crawlspace wall must be insulated to at least Table 2 or REScheck™ crawlspace wall requirements. The 2003 IECC Section 602.1.7 states that if the floor above a crawlspace is not insulated, then crawlspace vents open to the outside cannot be installed.

NOTE: *June 2005 a code change is currently being considered by amending the 2003 IECC to allow vents or temporary vents to be installed, with building code jurisdiction approval, in a crawlspace where high water sources or high moisture concerns are present.* If permanent vents are allowed, builders may be required to install a ground vapor retarder and provide a way of closing, sealing and insulating vent openings to at least R-10 and instruct homeowners about their use. This can be accomplished with tight fitting 2-inch thick foam blocks. Crawlspace vents should not be closed if they are part of the combustion air system of the building. Contact your building code jurisdiction for an update and **requirements.**

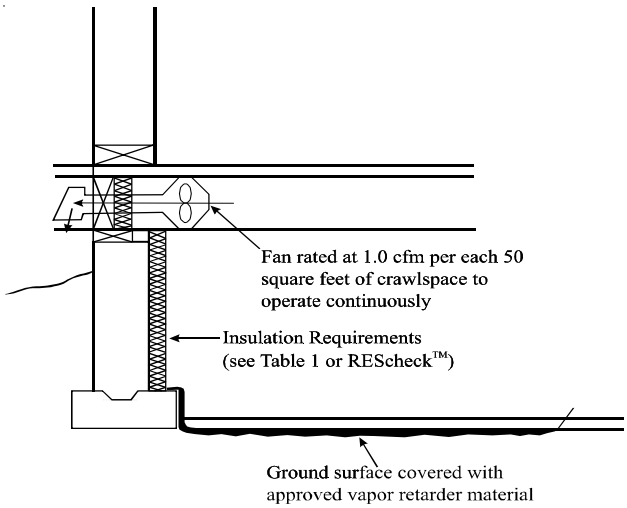
Insulated Crawlspace Foundation Wall Options are to Exhaust Air from the Crawlspace or to Supply Conditioned Air into the Crawlspace

Crawlspace Exhaust Air Option

This code option requires continuously exhausted air from the crawlspace at a rate of 1 cubic foot per minute (cfm) for each 50 square feet of crawlspace or 20 cfm per 1000 square feet of crawlspace. The ground in the crawlspace must be covered with an approved vapor retarder, usually 6 mil poly. Generally, there are enough openings into the upper floor to provide make-up air for the fan. If the floor is tightly constructed, one or two openings (transfer grilles) may be necessary to provide make-up air for the fan. This option provides a continuous flow of fresh air into the house while exhausting stale air, enhancing indoor air quality.

Crawlspace Exhaust Air Option

FIGURE 3



Natural venting combustion appliances such as conventional gas water heaters are not recommended to be installed in mechanically ventilated crawlspaces because of backdrafting concerns. Sealed combustion appliances are acceptable when installed and documented for safe operation by qualified personnel.

Supply Conditioned Air into Crawlspace Options

The intent of this code option is to treat crawlspaces with foundation wall insulation as semi-conditioned spaces. Consider that most basements are conditioned, or semi-conditioned, spaces and basements do not require venting. The purpose of venting was to help dry the crawlspaces if moisture was present, however, in many cases the major source of crawlspace moisture is ground moisture evaporation. A well-sealed ground moisture barrier should reduce moisture entering the crawlspace. The moisture barrier is recommended to be a minimum of 6-mil poly with all seams sealed, and sealed to the footing and other obstructions. For longevity, a thicker, more durable ground cover is recommended. Sealing the ground cover is not required by code but provides added assurance against moisture entering the crawlspace. A sealed ground cover is part of a radon control system which should assist with the removal of evaporating ground moisture. See Figure 5 - Radon system is not required by code.

Conditioning a crawlspace means to treat it as if it were part of the living area of the house. Code required conditioning can be accomplished by supplying a small amount of airflow into the crawlspace. The recommendation is to supply 1 cfm (cubic foot per minute) of airflow for each 50 square feet of crawlspace or 20 cfm per 1000 square feet of crawlspace. An option for controlling supply air is to install an adjustable 4-inch round diffuser grille in the supply duct. Large crawlspaces may require additional grilles. Listed below are three options used for conditioning crawlspaces.

1) Heat recovery ventilator providing supply and return air
2) Heating/air conditioning system providing supply air
3) Supplemental fan providing supply air

During the season when the heating/air conditioning system would not be operating, a recommendation is to have the air handler or supplemental fan cycled on for 5 minutes each hour. Generally the floor separating the crawlspace and upper floor has enough openings to allow for air flow between areas. However, with tight floor assemblies, openings are recommended.

If the crawlspace is conditioned with heating/air conditioning supply air, supplemental fan or mechanical exhausting air, code jurisdictions may require opening(s) be placed between the crawlspace and floor above. Generally one or two 4-inch by 8-inch transfer grilles are recommended.

Air Sealing Requirements

Section 502.1.4.2

Uncontrolled air leakage can significantly increase heating bills and cause uncomfortable drafts. Therefore, the energy code requires sealing of air leakage locations.

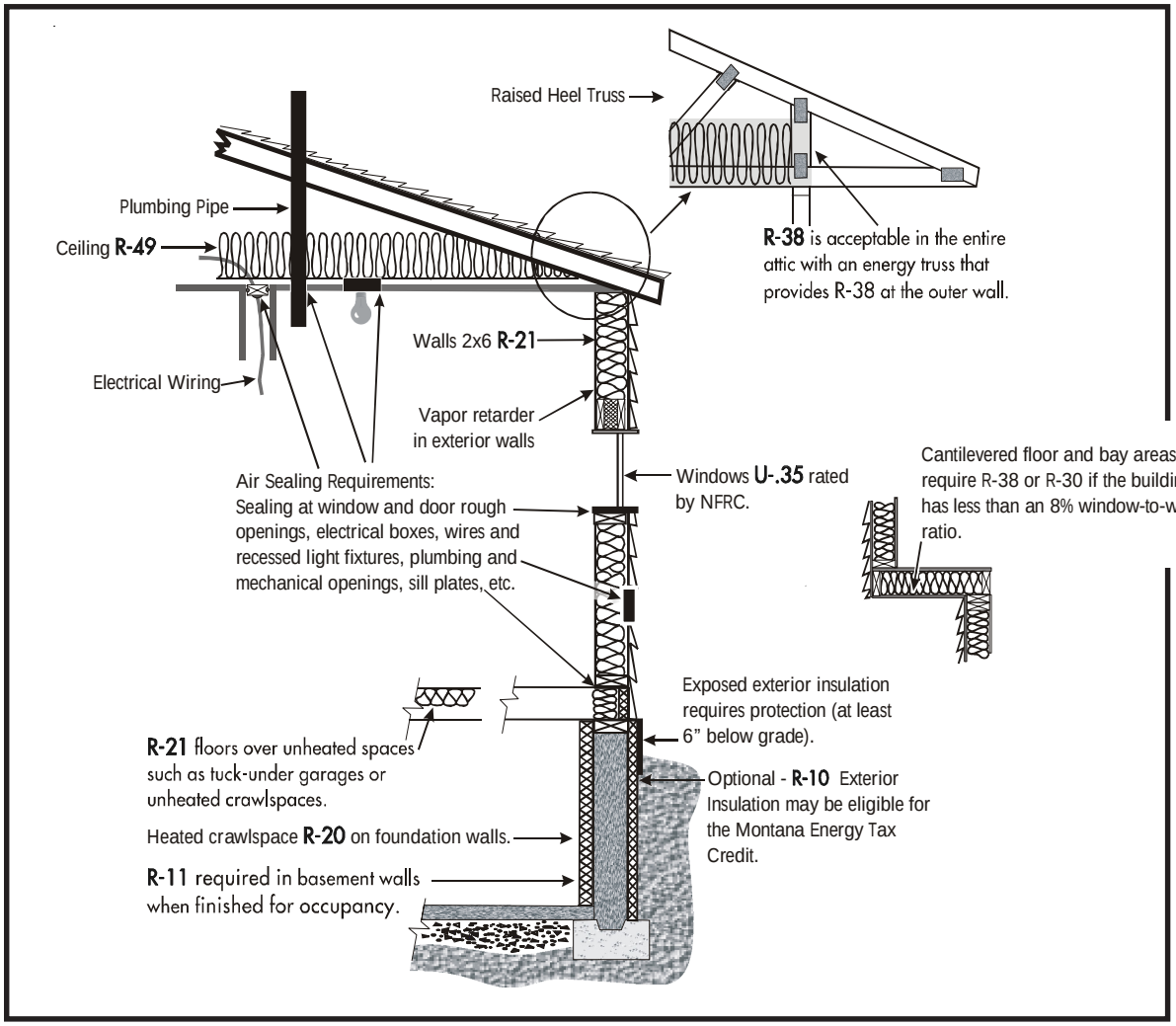
Some of the major air leakage areas that must be sealed with durable caulk or foam sealant are:

1. Openings between the building structure and exterior windows and door frames;
2. Openings around electrical wire, boxes, recessed light fixtures, and plumbing piping through the attic, exterior walls and other unheated spaces.

These locations are shown on Figure 4. (Note: *fiberglass and cellulose do not stop airflow and do not qualify as sealants*)

Sealing air leaks significantly reduces energy loss. A well sealed home should have a mechanical ventilation system, although not required by code, to ensure good indoor air quality. Mechanical ventilation options range from a quiet bathroom fan rated at 1.5 sone sound rating or less, to heat recovery ventilation system. Heat recovery systems bring fresh air into the house and reclaim or recover about 80 percent of the heat from the stale air that is being drawn out of the house, and are eligible for the energy tax credit.

FIGURE 4. Air Sealing and Simplified Prescriptive Path Insulation Requirements



Recessed Light Requirements

Section 502.1.3

When a recessed light is installed in a ceiling (with unheated attic space above), it must meet one of the following:

1. Type IC rated fixture with no openings into the attic, or sealed or gasketed to prevent air leakage into the attic.
2. Type IC or non-IC rated and installed inside a sealed ½ inch gypsum wallboard or other air-tight assembly manufactured for this purpose with clearances of at least ½ inch from combustible material and at least 3 inches from insulation material.
3. Type IC rated with ASTM E 283 allowing no more than 2 cubic feet per minute (CFM) of air movement.

Proper Sizing of Heating and Cooling Systems Section 503.3.1

In the past many heating and air conditioning systems were substantially oversized, resulting in increased installation and operating costs. 2003 IECC requires heating and cooling systems to be designed using procedures listed in the ASHRAE handbook, ACCA Manual J or approved equivalent computation procedure.

Heating System Duct Sealing Requirement Section 503.3.3.4.2

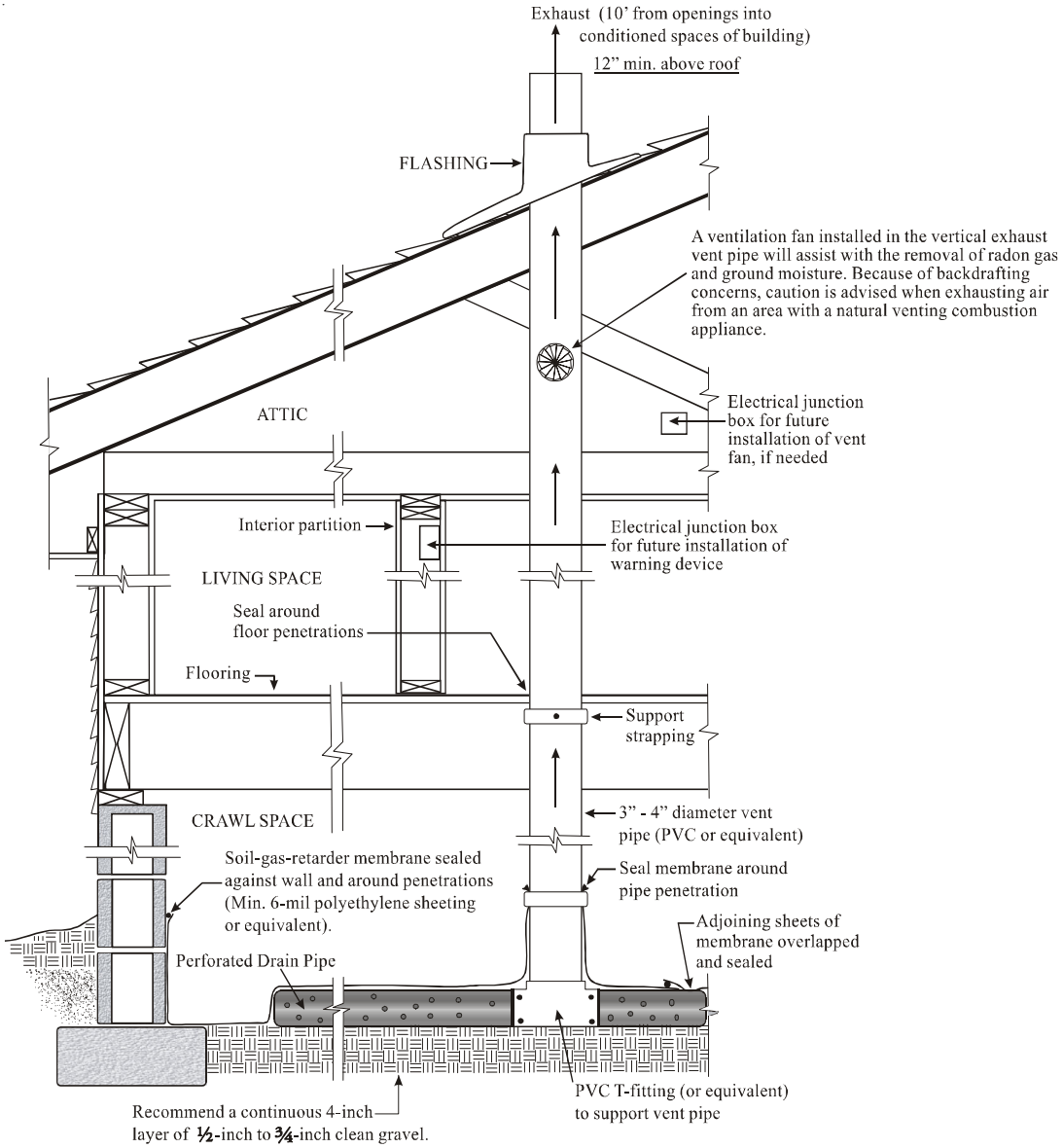
All joints, seams and connections in ductwork must be securely fastened and sealed with UL 181 A or B labeled mastics or tapes. Regular duct tape will not meet these requirements. This requirement applies to all ductwork regardless of location in the building. Continuous longitudinal seams do not need sealing.

Because of the potential for high indoor levels of radon, the Montana Department of Environmental Quality recommends new houses have basic radon abatement components installed during construction. Contact the Montana Radon hotline for more information at 1-800- 546-0483.

Passive Radon Control System in Crawlspace With Potential to Remove Some Ground Moisture

Additional Information
Radon Systems are not Required by Code

FIGURE 5



Energy Efficiency Components Label

Labels are available at no cost from many sources. Several utility companies are distributing labels as a public service. Local Montana Homebuilder Association offices in Billings, Bozeman, Great Falls, Helena, Kalispell, and Missoula distribute labels to their members.

Labels are also available from:

Montana Department of Environmental Quality • Air, Energy and Pollution Prevention Bureau
1100 N Last Chance Gulch, P. O. Box 200901 • Helena, Montana 59620-0901

or by calling the Montana Department of Environmental Quality at (406) 841-5200.
Also, camera ready copies are available from our DEQ website:
http://www.deq.mt.gov/Energy/index.asp

FIGURE 6. Energy Efficiency Components Label with Simplified Prescriptive Path Listing

ENERGY EFFICIENCY COMPONENTS

Address:_____

		Insulation* Value
Ceiling	Flat	R- 49
	Vaulted	R-
Walls:	Above grade walls	R- 21
	Basement walls (finished)	R- 11
	Crawlspace foundation	R- 20
Floors:	Over unheated spaces	R- 21
	Perimeter slab	R- 13
	Under slab	R-
Exterior doors:		R- .35
Windows:	NFRC unit rating (or)	U-
	Default window rating	U-
Water heater:	Energy factor (EF) rating	.54
Heating system:	Energy efficiency rating (AFUE for gas; HSPF heat pump)	78%
Heating ducts:	Systems sealed Yes X No	
	In non-conditioned areas insulated to Supply R-11 Return R-6	

Other (i.e., ventilation systems, radon abatement) _____

_____

Insulation Subcontractor:_____

Certified by:_____ Date:_____

Builder (Company):_____

The home builder certifies compliance with ARM 24.301.162 by completing and signing this label.

THIS LABEL MUST BE PERMANENTLY AFFIXED BY HOME BUILDERS TO THE INTERIOR BREAKER PANEL ON ALL NEW RESIDENTIAL BUILDINGS, AS REQUIRED BY SECTION 50-60-803, MONTANA CODE ANNOTATED

Montana Energy Conservation Tax Credit

Homebuyers are eligible for a state tax credit of up to $500 when they purchase or build an “above energy code” home or improve the efficiency of their existing home. For new houses, the credit is 25% of the “extra” cost of the building components, such as insulation levels, that are more energy efficient than the Montana energy code requirements. The “extra” cost – above standard models – for ENERGY STAR heating and cooling systems and programmable thermostats qualify for the credit. Refrigerators, clothes washers, and dryers do not qualify for the credit. Taxpayers should use tax form ENRG-C to claim the energy conservation tax credit.

Alternative Energy Systems Tax Credits

Homebuyers are eligible for the following Alternative Energy Systems Tax Credit:

geothermal $1,500, wind and solar $500, and eligible wood and pellet stoves $500.

Taxpayers should use tax form ENRG-B to claim the alternative energy tax credit.

Tax credit forms are available on line at **www.discoveringmontana.com/revenue/**.

Definitions of Some Energy Efficient Terms

A good comparison shopper needs to understand certain units of measurement, such as MPG (miles per gallon) when shopping for a new car. Shopping for energy efficiency also involves knowing a few units of measurement. Each Energy Efficiency Components Label may contain five or more different units of measurement. The following definitions will help you crack the code of energy efficiency.

R-VALUES – The units used to measure the insulating value of an object. The higher the R-value, the more insulating value an object has. A high density batt of fiberglass insulation for a 2” x 6” wall has an R-value of 21.

U-VALUES – Another unit of insulation measurement, U-values, measure heat loss through windows. The U-value of a window is the reciprocal of its R-Value (U = 1/R). For instance, a window with a U-value of 0.33 is equivalent to an R-value of 3 (0.33 = 1/3). Because the U-value is the inverse of the R-value, a lower U-value indicates a window that has better insulating capabilities than a window with a higher U-value.

NFRC UNIT RATING – The National Fenestration Rating Council (NFRC) determines the U-value for most windows. This rating is placed on a label attached to all new NFRC rated windows. If the NFRC rating is available, the home builder should use this number when filling in the U-value on the Energy Efficiency Components Label for a new home. Windows with a U-value of 0.4 or less usually have a low-e coating.

EF – Used to determine the energy efficiency of hot water tanks, EF is the abbreviation for “Energy Factor.” This unit is a ratio of the heat energy contained in the water in a hot water tank over a certain period of time divided by the energy that the hot water heater consumes over the same time period. The most efficient electric water heaters have an EF rating of 0.93 to 0.96, while the most efficient gas-fired water heaters have energy factors ranging from 0.60 to 0.86.

AFUE – An abbreviation for “Annual Fuel Utilization Efficiency.” AFUE is a measure of the effectiveness of gas and oil space heating systems. All furnaces and boilers in the United States are required to have an AFUE rating of at least 78 percent. The most efficient gas furnaces have an AFUE of 92 percent to over 96 percent, while the most efficient gas hot-water boilers have AFUE ratings of around 84 percent to 90 percent. Energy-efficient oil furnaces

Definitions of Some Energy Efficient Terms - ***continued from page 11***

have similar AFUE ratings, in the mid-80s to 90 percent. The most efficient oil-fired hot water boilers have efficiencies that are slightly lower, with AFUE ratings up to around 85 percent. Gas or oil-fired steam boilers have somewhat lower ratings, with the most energy-efficient units having an AFUE around 80 percent.

HSPF – Heating Season Performance Factor is the measurement unit for determining the efficiency of heat pumps. It is calculated by dividing the estimated seasonal heating output (in Btu) by the seasonal power consumption (in watts). The most efficient electric heat pumps on the market have an HSPF of between 7.7 and 10.

SEER – **Seasonal Energy Efficiency Ratio**. The total cooling output of an air conditioner during its normal annual usage period for cooling, in Btu/hours, divided by the total electric energy input during the same period in watt-hours.

A copy of the 2003 International Energy Conservation Code is available for purchase from the International Code Council at **www.iccsafe.org.**

Following are some websites with additional energy conservation information:

■ Advanced Energy	Raleigh, NC	**www.crawlspaces.org**
■ Building Science Corporation	Westford, MA	**www.buildingscience.com**
■ Efficient Windows Collaborative	Washington, DC	**www.efficientwindows.org**
■ Energy and Environmental Building Association	Bloomington, MN	**www.eeba.org**
■ Energy Federation Inc., high performance building products		**www.efi.org**
■ EPA Home Performance with Energy Star	Washington, DC	**www.energystar.gov**
■ Lawrence Berkeley Laboratory/, Energy Performance of Buildings Groups	Berkeley, CA	**epb1.lbl.gov/EPB**
■ National Center for Appropriate Technology	Butte, MT	**www.ncat.org**
■ Partnership for Advancing Housing Technology (PATH)	Washington, DC	**www.pathnet.org**
■ U.S. Department of Energy	Washington, DC	**www.eere.energy.gov**
■ Northwest Energy Star Homes		**www.northwestenergystar.com**
■ National Fenestration Rating Council		**www.nfrc.org**
■ Montana Green Power		**www.montanagreenpower.com**

Look for the ENERGY STAR certification on windows, heating, air conditioning systems, and appliances.

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